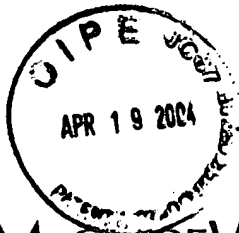


McGuireWoods LLP  
1750 Tysons Boulevard  
Suite 1800  
McLean, VA 22102-4215  
Phone: 703.712.5000  
Fax: 703.712.5050  
www.mcguirewoods.com

Hae-Chan Park  
Direct: 703.712.5365



McGUIREWOODS

*copy*  
*[Signature]*

hpark@mcguirewoods.com  
Direct Fax: 703.712.5280

April 19, 2004

**Certificate**  
**APR 23 2004**  
**of Correction**

Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

Re: U.S. Utility Patent Application  
U.S. Patent No. 6,717,637 B1, issued on April 6, 2004  
U.S. Patent Application No. 09/431,157  
Filed: November 1, 1999  
**LIQUID CRYSTAL DISPLAY HAVING WIDE VIEWING ANGLE**  
Inventors: Yea-Sun YOON, *et al.*  
Our Ref.: 6192.0114.AA

Sir:

The following documents are forwarded herewith for appropriate action by the U.S. Patent and Trademark Office:

1. Request for Certificate of Correction (Applicant's Mistake);
2. Certificate of Correction Form PTO 1050 indicating the requested correction;
3. A marked-up copy of the Letters Patent indicating the requested correction in red ink;
4. Our check no. 167263 in the amount of \$100.00 to cover the cost of filing this Request for Certificate of Correction; and
5. One (1) acknowledgement postcard.

It is respectfully requested that the attached copy of the postcard be stamped with the filing date of these documents and returned to our courier.

APR 26 2004

U.S. Patent and Trademark Office  
April 19, 2004  
Page 2

The U.S. Patent and Trademark Office is hereby authorized to charge any fee deficiency, or credit any overpayment, to our Deposit Account No. 23-1951 referencing docket number 6192.0114.AA.

Respectfully submitted,

A handwritten signature in black ink, appearing to read 'Hae-Chan Park', written in a cursive style.

Hae-Chan Park  
Reg. No. 50,114

HCP/bjb  
Enclosures



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Patentees: Yea-Sun YOON, *et al.*

Issued: April 6, 2004

Patent No.: 6,717,637 B1

For: **LIQUID CRYSTAL DISPLAY HAVING WIDE VIEWING ANGLE**

Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

**REQUEST FOR CERTIFICATE OF CORRECTION  
UNDER 37 C.F.R. 1.323  
APPLICANT'S MISTAKE**

Sir:

Transmitted herewith in duplicate is PTO Form 1050 - Certificate of Correction for the above-identified U.S. Patent correcting the Applicant's mistake as shown in the enclosed Certificate of Correction form. Also attached is a copy of the Letters Patent, with the requested correction marked in red ink.

Issuance of a Certificate of Correction is in order. Since this matter was incorrectly shown on the Reply and Amendment Under 37 C.F.R. § 1.111 filed with the U.S. Patent and Trademark Office on June 17, 2002, our check no. 167263 in the amount of \$100.00 is submitted herewith.

~~04/21/2004 HALI22 00000112 09431157~~

~~01 FC:1811 100.00 DP~~

Adjustment date: 04/22/2004 HALI22  
04/21/2004 HALI22 00000112 09431157  
01 FC:1811 -100.00 DP

04/22/2004 HALI22 00000009 6717637  
01 FC:1811 100.00 DP

APR 26 2004

Please charge any deficiencies and credit any overpayments to attorney's deposit  
account no. 23-1951.

Respectfully submitted,

A handwritten signature in black ink, appearing to read 'Hae-Chan Park', written in a cursive style.

Hae-Chan Park  
Reg. No. 50,114

Date: April 19, 2004

McGuireWoods LLP  
1750 Tysons Boulevard, Suite 1800  
McLean, VA 22102  
(703) 712-5000

UNITED STATES PATENT AND TRADEMARK OFFICE  
**CERTIFICATE OF CORRECTION**

PATENT NO.: 6,717,637 B1  
DATED: April 6, 2004  
INVENTORS: Yea-Sun YOON, *et al.*

It is certified that errors appear in the above-identified patent and that said Letters Patent is hereby corrected as shown below.

Column 8,  
Line 30, Change "indium thin" to --indium tin--.

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McLean, VA 22102  
(703) 712-5000

PATENT NO.: 6,717,637 B1  
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**APR 26 2004**

UNITED STATES PATENT AND TRADEMARK OFFICE  
**CERTIFICATE OF CORRECTION**

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(703) 712-5000

PATENT NO.: 6,717,637 B1  
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APR 26 2004



(12) **United States Patent**  
Yoon et al.

(10) Patent No.: **US 6,717,637 B1**  
(45) Date of Patent: **Apr. 6, 2004**

(54) **LIQUID CRYSTAL DISPLAY HAVING WIDE VIEWING ANGLE**

(75) Inventors: Yea-Sun Yoon, Seoul (KR);  
Seung-Beom Park, Kyungki-do (KR)

(73) Assignee: Samsung Electronics Co., Ltd., Suwon (KR)

(\*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: 09/431,157

(22) Filed: Nov. 1, 1999

(30) Foreign Application Priority Data

Oct. 30, 1998 (KR) ..... 98-46153

(51) Int. Cl.<sup>7</sup> ..... G02F 1/1335

(52) U.S. Cl. .... 349/106; 349/130

(58) Field of Search ..... 349/106, 129,  
349/143, 110, 130

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\* cited by examiner

Primary Examiner—Kenneth Parker

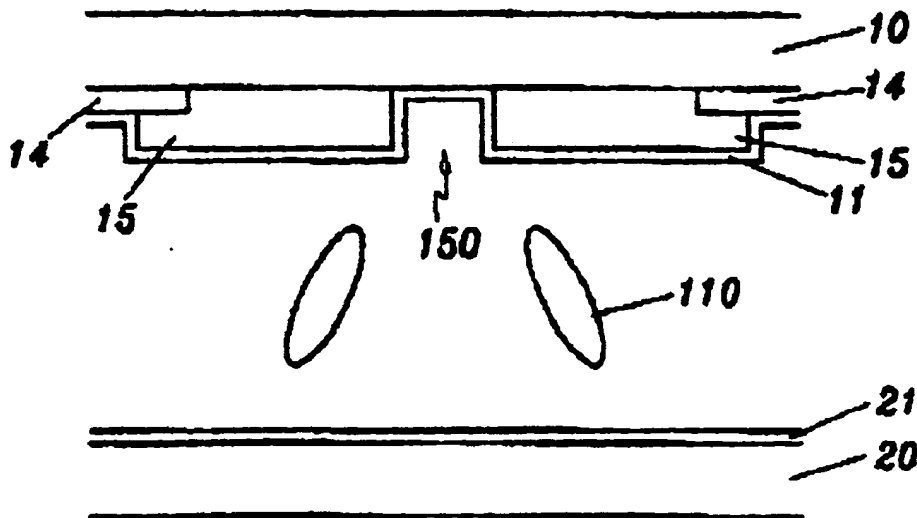
Assistant Examiner—David Chung

(74) Attorney, Agent, or Firm—McGuireWoods LLP

(57) **ABSTRACT**

Color filters of an LCD are formed so as to have grooves. A common electrode is formed thereon to have a rugged non-smooth profile due to the grooves. A skewed electric field is formed due to the rugged non-smooth profiled common electrodes. Two domains in which alignment directions of liquid crystal molecules are opposite to each other are separated by the grooves as a boundary, and hence, the viewing angle of the LCD is broadened. A black matrix may be formed to overlap the grooves to reduce light leakage induced due to the groove. To prevent common electrodes from disconnecting around the groove, the common electrode layer is preferably thinly deposited two times.

30 Claims, 7 Drawing Sheets



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11. The liquid crystal display as recited in claim 6, wherein the grooves and the apertures form closed domains when they are viewed from above.

12. The liquid crystal display as recited in claim 6, wherein the grooves and the apertures are symmetrically arranged relative to each other.

13. The liquid crystal display as recited in claim 6, wherein the apertures have a first portion extending in a first direction and a second portion extending in a second direction that is different from the first direction.

14. The liquid crystal display as recited in claim 13, wherein the first direction and the second direction are perpendicular to each other.

15. The liquid crystal display as recited in claim 6, further comprising a liquid crystal layer interposed between the first substrate and the second substrate and having liquid crystal molecules of which long axes are vertically aligned relative to the first and the second substrates in the absence of an electric field.

16. The liquid crystal display as recited in claim 15, wherein the liquid crystal molecules have negative dielectric anisotropy.

17. The liquid crystal display as recited in claim 16, wherein the liquid crystal molecules have chirality.

18. The liquid crystal display as recited in claim 15, further comprising a first and a second polarizing films respectively attached on the outer surfaces of the first and the second substrates, wherein polarizing axes of the first and the second polarizing films are perpendicular to each other.

19. The liquid crystal display as recited in claim 15, wherein a plurality of minute domains are formed in a pixel area by the grooves and the apertures.

20. The liquid crystal display as recited in claim 19, wherein the minute domains' average direction of the long axes of liquid crystal molecules are directed toward two directions.

21. The liquid crystal display as recited in claim 19, wherein the minute domains' average direction of the long axes of liquid crystal molecules are directed toward four directions.

22. The liquid crystal display as recited in claim 20, wherein the average long axes make an angle of  $40^\circ$  to  $50^\circ$  with the polarizing directions of the first and the second polarizing films.

23. The liquid crystal display as recited in claim 21, wherein the average long axes make an angle of  $40^\circ$  to  $50^\circ$  to the polarizing directions of the first and the second polarizing films.

24. A liquid crystal display, comprising:

a first substrate;

a pixel electrode formed on the first substrate;

a plurality of pixel regions, each pixel region being defined as a region overlapping a corresponding one of the plurality of pixel electrodes;

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a second substrate facing with the first substrate; and

a common electrode formed on the second substrate,

wherein the common electrode has a plurality of grooved portions, each grooved portion is formed within a corresponding one of the plurality of pixel regions and dividing the corresponding pixel region into a plurality of domains.

25. The liquid crystal display recited in claim 24, further comprising color filters having a plurality of grooves and formed on the second substrate,

wherein the plurality of grooved portions of the common electrode are formed due to the grooves of the color filters.

26. The liquid crystal display recited in claim 24, further comprising a black matrix portion formed between the groove and the second substrate.

27. A method of manufacturing a panel for a liquid crystal display, comprising the steps of:

forming a black matrix on a substrate;

forming color filters having grooves on the substrate, each groove is formed within a corresponding one of a plurality of pixel areas and divides the corresponding pixel area into a plurality of domains; and

forming a common electrode on the color filters.

28. The method of manufacturing a panel for a liquid crystal display recited in claim 27, wherein the common electrode is form by two depositions of ITO (indium tin oxide).

29. The method of manufacturing a panel for a liquid crystal display recited in claim 27, wherein the step of forming color filters having grooves comprises the substeps of:

coating and patterning a red colored photoresist to form red color filters having grooves located in a pixel area defined by the black matrix;

coating and patterning a green colored photoresist to form green color filters having grooves located in a pixel area; and

coating and patterning a blue colored photoresist to form blue color filters having grooves located in a pixel area.

30. The method of manufacturing a panel for a liquid crystal display recited in claim 27, wherein the step of forming the color filters comprises the substeps of:

sequentially forming red, green, and blue color filters by coating and patterning a red colored photoresist, a green colored photoresist, and a blue colored photoresist; and

patterning the red, green and blue color filters to form the grooves.

\* \* \* \* \*